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(54) Method for Producing Detergent Sheet

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Clean Copy of Specification (No Change in Meaning)

SPECIFICATION[1]

1. Title of the Invention

Method for Producing Detergent Sheet

2. Claims

(1) A method for producing a readily foaming detergent sheet by depositing a detergent on a sheet comprising a water-soluble polymer material, a water-soluble nonwoven fabric, or a water-dispersible nonwoven fabric, wherein this method for producing a detergent sheet is characterized in that the sheet is perforated before the detergent is deposited.

3. Detailed Description of the Invention

The present invention relates to a detergent sheet, and more particularly to a method for producing a detergent sheet having adequate foaming power and detergency.

In conventional practice, detergent sheets are highly popular because of their portability. These detergents are also referred to as "paper soap," sheet soap," and the like.

The following principal methods can be cited as examples of conventionally used methods for producing detergent sheets.

(1) Methods in which a mixed aqueous solution of a surfactant and a water-soluble polymer material is dried to form a thin film, yielding a detergent sheet (refer to JP (Kokai) 53-91912 and 53-91913).

(2) Methods in which a water-soluble polymer material fashioned into a paperlike sheet, a nonwoven fabric obtained by binding fibers with a water-soluble or water-

[1] Translator's note: The amendments on the last page of the original have been incorporated into the translation.

dispersible sizing agent, or the like is passed through a solution of a foaming or cleansing surfactant in water or an organic solvent, or the solution is sprayed onto the sheeted material and dried.

The first group of methods is advantageous in that the resulting detergent sheet is readily soluble in water, but these methods require the use of specialized complex production equipment, and are therefore difficult to carry out by those lacking such equipment.

The second group of methods is widely accepted because it is based on simple manufacturing processes, but the detergent sheets produced by these methods commonly exhibit inadequate foaming properties during application, making it necessary for the surfactants to be deposited in large amounts on a substrate sheet in order to attain the desired foaming and cleansing properties. When liquid surfactants are deposited in large amounts in this manner, the surface of the resulting detergent sheet tends to acquire pronounced tackiness, sometimes causing two detergent sheets facing each other to undergo blocking. Detergent sheets obtained using solid surfactants are apt to shed the surfactants or have a stiff feel, resulting in reduced commercial value.

The inventors perfected the present invention as a result of extensive research aimed at establishing a method for producing a detergent sheet devoid of the above-described shortcomings.

Specifically, the present invention relates to a method for producing a detergent sheet having excellent foaming and cleansing properties, characterized in that numerous holes are formed in advance in a water-soluble or water-dispersible polymer material fashioned into a paperlike sheet or in a nonwoven fabric (hereinafter abbreviated as "sheet") obtained by binding fibers with a water-soluble or water-dispersible sizing agent; and the sheet is sprayed with a surfactant dissolved in water, an organic solvent, or a mixture thereof, or is passed through the surfactant solution and dried. The detergent sheet produced by the method of the present invention is characterized by having adequate foaming and cleansing properties, being able to retain the surfactant, and being devoid of the stiff feel.

Materials (such as "Disolv WA" manufactured by Mishima Paper) primarily composed of carboxymethyl cellulose (CMC) spread into a paperlike form, starch-based substances spread into a paperlike form, and nonwoven fabrics obtained by bonding pulp fibers with CMC may be sited as the sheet materials that can be used in the method of the present invention. However, any starting material may be used as long as a water-soluble or water-dispersible paperlike substance can be obtained using water-soluble cellulose derivatives (such as carboxymethyl cellulose, methylcellulose, hydroxyethylcellulose, and hydroxypropylcellulose), water-soluble starch, polyvinyl alcohol, polyvinyl pyrrolidone, polyacrylates, carboxyvinyl polymers, sodium alginate, or gum arabic, or the like. It is also possible, for example, to admix fibers or other water-insoluble substances into such water-soluble or water-dispersible paperlike substances in order to improve their strength or the like as long as the paperlike substances are soluble or dispersible in water.

According to the method of the present invention, at least one of the following surfactants is selected for deposition on the sheet: soap, alkyl aryl sulfonates, higher alcohol sulfate ester salts, alkane sulfonates, alkene sulfonates, higher fatty acid isethionate ester salts, *N*-acyl sarcosine salts, *N*-acyl-β-alanine salts, *N*-acyl glutamates, α-sulfo higher alcohol acetate esters, and other anionic surfactants; higher alcohols, higher fatty acid amides, higher fatty acid alkanolamides, and other polyoxyalkylene derivatives; alkylene oxide block polymers, polyol esters, polyalkylene oxide derivatives thereof, alkyl phenol polyalkylene oxide derivatives, and other nonionic surfactants; betaines, aminoamide compounds, and other ampholytic surfactants; cationic surfactants; and the like.

The following components may also be added to the detergent sheet of the inventive method besides the aforementioned surfactants: pigments, fragrances, disinfectants, and other components commonly added to detergents; 2-pyrrolidine-5-carboxylates, lactates, hydrolytic proteins, *N*-acetyl glycine salts, and other skin-moisturizing components; lanolin, derivatives thereof, higher alcohols, higher fatty acids, isopropyl myristate, myristyl myristate, cholesterol, lecithin, and other emollients; and the like.

Although the method of the present invention does not impose any particular limitations on the size of sheet perforations or the ratio of combined perforated area and total sheet area, the ratio of combined perforated area and total sheet area should preferably be between 5:95 and 50:50. It is impossible to increase detergent deposition or to make sheet perforation effective in cases in which the holes are small, the combined perforated area does not exceed 5%, and the total area of the sheet portion is 95% or greater. It is also undesirable to have a situation in which the holes are large, the combined perforated area is 50% or greater, and the total area of the sheet portion is 50% or less because in this situation the detergent sheet has a pronounced tendency to curl and becomes difficult to use. Hole size and the ratio of combined perforated area and total sheet area have an effect on the pliability of the detergent sheet, and must therefore be determined with consideration for the thickness and stiffness of the sheet being used. The shape and size of the perforation in the sheet need not be uniform. Accordingly, brand names, patterns, and the like may be arbitrarily displayed on the detergent sheet by combining perforations of different shapes and sizes.

The present invention is explained in detail below through working examples.

Working Example 1, Comparative Example 1

A sheet ("Disolv WA," registered trade name of a product manufactured by Mishima Paper) obtained by spreading carboxymethylcellulose into a paper sheet with a thickness of about 0.12 mm was cut to obtain a segment measuring 70 mm in width and 1000 mm in length, and was perforated and provided with regularly arranged rectangular holes measuring 1.5 mm × 4.0 mm such that the combined perforated area was 30% and the total area of the paper portion was 70%. The perforated sheet was held at a temperature of 60–65℃; immersed in a detergent solution of 200 parts sodium lauryl sulfate, 100 parts polyethylene glycol (molecular weight: about 6000), 200 parts ethanol, and 80 parts water; air-dried after being pulled through a slit with a clearance of 0.5 mm composed of two glass rods; and cut into pieces measuring 70 mm × 50 mm. An unperforated sheet was subjected to the same treatment and tested for increased weight

due to detergent deposition, foaming properties based on hand washing tests, and the tactile sensation created by the detergent sheet. The results are shown in Table 1.

Table 1

	Working Example 1	Comparative Example 1
Weight before deposition of detergent[1] (A)	0.140 g/sheet	0.200 g/sheet
Combined perforated area	10.5 cm^2	0.0 cm^2
Total area of paper portion	24.5 cm^2	35.0 cm^2
Weight after deposition of detergent[2] (B)	0.435 g/sheet	0.448 g/sheet
Weight of deposited detergent (B–A)	0.295 g/sheet	0.248 g/sheet
Foaming at time of application[3]	+2	±
Tactile sensation[4]	Elastic feel	Stiff feel

Remarks

1) Average weight of ten arbitrary sheets was measured after the sheets were cut to 70 mm × 50 mm before immersion in the detergent solution.

2) After immersion in detergent solution, the air-dried material was cut to 70 mm × 50 mm, and the average weight of ten arbitrary sheets was measured.

3) The amount of foam generated during a test in which a detergent sheet was placed in the palm and the hands were washed using tap water was evaluated according to the following grading system.

± Average, –1 Less than average, –2 Much less than average, +1 Better than average, +2 Much better than average

4) The sensation produced when a small portion of the short side of the detergent sheet was pinched, and the sheet detergent was lightly shaken up and down.

Working Example 2

A piece measuring 70 mm in width and 1000 mm in length was cut out from the sheet used in Working Example 1, graduation lines were drawn with a pencil on the cut piece to obtain sections measuring 70 mm in width and 50 mm in length, and "Kawaken" was carved in No. 1 Gothic type in the middle of each section. Holes measuring 2 mm × 2 mm were formed across the entire sheet around the carved characters. The ratio of combined perforated area and total sheet area in each of the sections thus obtained was

20:80. The perforated sheet measuring 70 mm × 1000 mm was immersed in a detergent solution with the same composition as in Working Example 1, passed through a slit formed by two glass bars, pulled out, air-dried, and cut to 70 mm × 50 mm. These operations produced a sheet detergent covered with a detergent everywhere except in the areas containing the characters "Kawaken" and the holes around them. The detergent sheet had a pliable feel, had a degree of foaming that corresponded to the +2 grade when tested during hand washing with tap water, and did not curl during the handwashing test.